

A night to remember

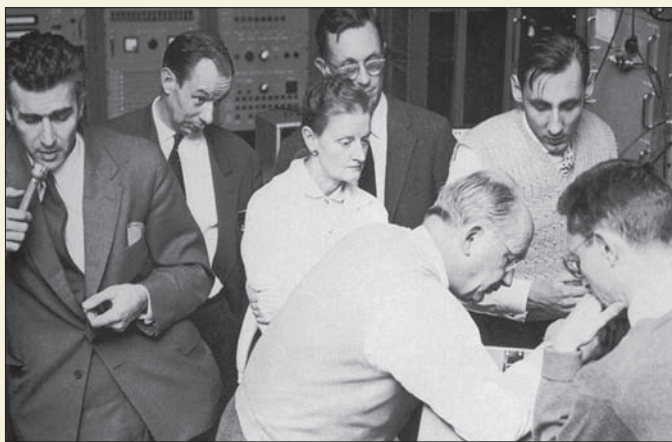
In this article written for *CERN Courier* in 1969, **Hildred Blewett** gives a personal account of the events leading to the start-up of CERN's Proton Synchrotron on 24 November 1959, on the very evening before was she was scheduled to return to the US.

Remember the night of 24 November 1959? Of course I do. I was sitting in the canteen eating supper with John Adams, as we had done many times that fall. There was not a wide choice of food in those days – spaghetti or ravioli or, occasionally, fried eggs – but our thoughts were not on the meal. We had hardly spoken, our spirits were low, then John lit his pipe and said, “Well, now that we’ve finished eating, we might as well walk over and see if anything is happening.” As we went in the direction of the PS buildings, I asked him, “Shall we go to the Main Control Room or over to the Central Building? Chris Schmelzer said that Wolfgang Schnell has that radial phase-control thing working.” John pulled on his pipe, “Probably doesn’t matter, it may not do much good.” Our hopes had been dashed fairly often. Then, after a few more steps, he added, “Let’s go to the Central Building and see what they’re up to.” It was about quarter to seven.

Trudging along, I thought back over the past weeks, back to 16 September when, during the Accelerator Conference at CERN, Adams had made the electrifying announcement that protons injected into the PS had gone one turn round the magnet ring. Since that time, attempts to put the PS into operation had brought a few triumphant moments but most of the time we had been discouraged, puzzled by the beam’s behaviour, frustrated by faulty equipment or, after quick trials of this remedy or that, in despair over the lack of success. The protons just didn’t want to be accelerated.

I had to go back soon to help on the AGS. Pressure for high-energy protons in the United States was mounting even higher with the imminent production of European ones, so I had already booked passage to sail home. For some time I had been saying to everyone that we must get the protons through “transition” before I left. Now it was 24 November, I must leave Geneva the following day, but the prospects were bleak. Would this beam-night be any different?

Although the PS had been ready to accept protons from the linac



Expressions still worried as some of the commissioning team cluster around an oscilloscope. Left to right: John Adams (with pipe clutched in his left hand), Hans Geibel, Hildred Blewett, Lloyd Smith, Chris Schmelzer, Wolfgang Schnell and Pierre Germain. (Courtesy B Sagnell.)

system was ready for trial. Schmelzer and Hans Geibel were in the Central Building and Pierre Germain was peering at scopes in the Main Control Room. Linac said beam was ready and inflector working. Hine was in the MCR, looking at the injected beam, adjusting quadrupoles, changing inflector voltage, rushing from one scope to another. The beam isn’t spiralling properly... wait... all right, go ahead r.f.... Central Building says it’s on, programme on. Yes, beam is being captured... it’s accelerated... but lost after a few milliseconds. Changes in the r.f. programming... is the beam better... yes, now it goes for 10 milliseconds... no, it’s 15... now it’s gone again. But we went home satisfied – some beam had been captured, there had been some acceleration.

More evenings with trials of the r.f. programme followed. The r.f. system had been designed to run with a frequency programme to a few GeV, then to switch over to an automatic system with a phase-lock and with errors in the beam’s radial position fed back to the r.f. amplitude for correction. When this automatic system was ready, it was tried with switching-in much earlier than planned and this did succeed in accelerating the beam somewhat longer. But then it was lost, usually in a series of steps and all gone after a few tens of milliseconds. I don’t remember if we reached 2 or 3 GeV on an occasional pulse, but certainly no more. The behaviour of the beam remained erratic and unstable. What was wrong?

Measurements of the beam’s position on the radial pickup ▷

electrodes were hastily plotted by Adams to show that the closed orbit was off in some places, but only by a few centimetres, surely not enough to prevent some beam from going to transition. The rate of rise of the magnetic field was varied to look for eddy-current troubles. Colin Ramm and the Magnet Group rushed round the ring in the daytime, searching for stray fields or remanence effects. Jean Gervaise scanned the survey data for possible errors in magnet positions while Jack Freeman hunted for signs of beam disappearances with radiation monitors. More trials of the r.f., with and without phase-lock, more diagnostic equipment hurriedly inserted, more measurements. But the protons made no progress.

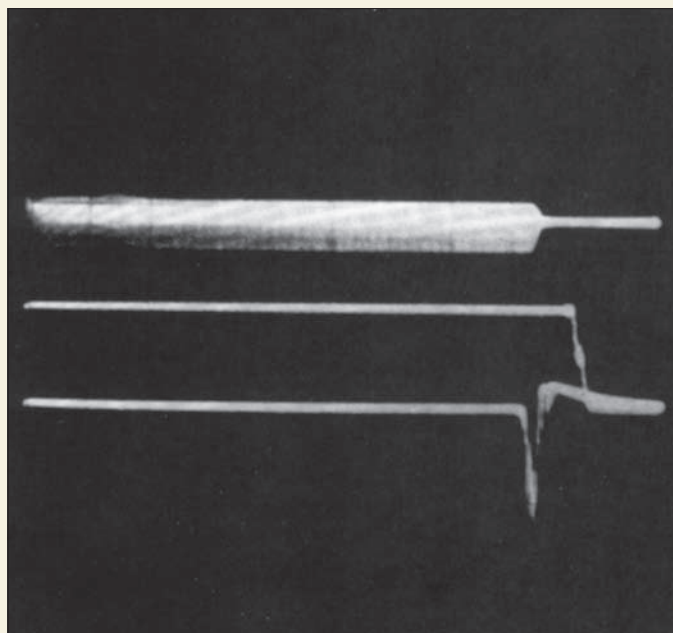
A broad green trace

During those Tuesday and Thursday evenings in October and early November, many of the PS builders gathered round the tables in the centre of the Main Control Room. At one stage, to save (or prevent?) people from going home to eat and being late for the scheduled 6 p.m. start-up, Hine arranged cold meats, cheese and bread to be sent to the MCR. As I recall this was not a rousing success. There were periods of frantic activity. But there were also long periods of waiting. We sat at the tables and waited and waited. One night, just as beam came on, all of the lights went out – trouble at the CERN main power house – and we groped our way out in darkness, Adams striking matches all the way.

I had a desk in Mervyn Hine's office where, in the mornings, particularly after beam-nights, one after another would come in – Johnsen, Hereward, Schoch, Schmelzer, sometimes Adams, many others – and the talk would start. Are the closed-orbit deviations causing serious trouble? Is the linac emittance all right? What about the missing bunches, caused by the poor performance of the inflector? Every Monday morning, in the PS Conference Room, there was a meeting of the "Running-in Committee", starting at 9 a.m. sharp and lasting until well after 1 p.m., or even 2 p.m. Discussions and arguments – on and on.

Occasionally, on a Sunday, I would go along the lake to visit my good friends, Kjell and Aase Johnsen, and we would recall the days in 1953 when the first designs for the PS were being worked out by groups in various places (Harwell, Paris, Heidelberg, Bergen etc.) all under the leadership of Odd Dahl in Bergen. John Blewett and I had spent some months in Bergen in the summer of 1953 and, during that time, Johnsen had been working on the behaviour of the beam at transition energy (where there is no phase stability). His calculations had given us the first confidence that beam could be accelerated through this dangerous region.

Many of these things were in my thoughts as Adams and I approached the Central Building. I was depressed about having to leave the next day, with the protons still balking. I had wanted so much to see this machine operate successfully before I left. All through the years, I had been so involved with CERN and its PS that I had felt a glow of pride with each milestone passed during construction. More than ever, over these past weeks, I had felt that it was partly my machine too. John interrupted my thoughts with, "Well, Hildred, we haven't done much during your stay. It's hardly been worthwhile, you haven't learnt...". I broke in, "Wolfgang thinks this radial phase-control will really work, he's very optimistic, and maybe...". But I knew that no-one else had great hopes for any improvement. Even Schmelzer had thought it was hardly worth the



Oscilloscope traces indicating that the PS had accelerated protons to an energy of 25 GeV. The top trace corresponds to beam circulating without energy loss, the middle trace shows the magnet voltage, and the bottom trace gives a signal at the end of the acceleration cycle, when beam is lost.

effort, but Schnell had gone ahead over the last couple of weeks wiring it up for a quick test. Just a few days before, I had been down in the basement lab, listening to his enthusiasm. The idea was to use the radial-position signal from the beam to control the r.f. phase instead of the amplitude. With this system, the sign of the phase had to be reversed at transition and, in his haste, Schnell had built this part into a Nescafe tin, the only thing of the right size.

Adams opened the door to the Central Building. For a moment the lights blinded us, then we saw Schmelzer, Geibel and Rosset – they were smiling. Schnell walked towards us and, without a word, pulled us over to the scope. We looked... there was a broad green trace... What's the timing... why, why the beam is out to transition energy? I said it out loud – "TRANSITION!"

Just then a voice came from the Main Control Room. It was Hine, sounding a bit sharp (he was running himself ragged, as usual, and more frustrated than anyone), "Have you people some programme for tonight, what are you planning to do? I want to...". Schnell interrupted, "Have you looked at the beam? Go and look at the scope." A long silence... then, very quietly, Hereward's voice, "Are you going to try to go through transition tonight?" But Schnell was already behind the racks with his Nescafe tin, Geibel was out in front checking that the wires went to the right places, not the usual wrong ones. Quickly, quickly, it was ready. But the timing had to be set right. Set it at the calculated value... look at the scope... yes, there's a little beam through... turn the timing knob (Schnell says that I yelled this at him, I don't remember)... timing changed, little by little ... the green band gets longer... no losses. Is it... look again... we're through... YES, WE'RE THROUGH TRANSITION!

How far? What's the energy? Something below 10 GeV because the magnet cycle is set for lower fields and a one-second repetition rate for testing. Hurried call to Georgijevic in the Power House. Change the magnet cycle to full field. Beam off while we wait. The

21

WHAT POWERS YOUR ACCELERATOR?

HV and RF Technology from L-3.

L-3 Electron Devices is leading the technology revolution with powerful solutions in all areas of high-energy particle physics. L-3 offers RF sources and high voltage switches to the world's leading accelerators and universities. Whether the application requires pulse or CW, UHF or microwave RF, L-3 has a klystron, IOT or TWT that can meet the demanding requirements of most systems. Our products have been supporting customers at SLAC, Argonne, LANL, Thomas Jefferson National Laboratory, Fermi and KEK, and L-3 can create a unique solution using our years of engineering knowledge and experience.

To learn more about L-3's innovative technology, visit L-3com.com/edd or e-mail us at wpt.marketing@L-3com.com.

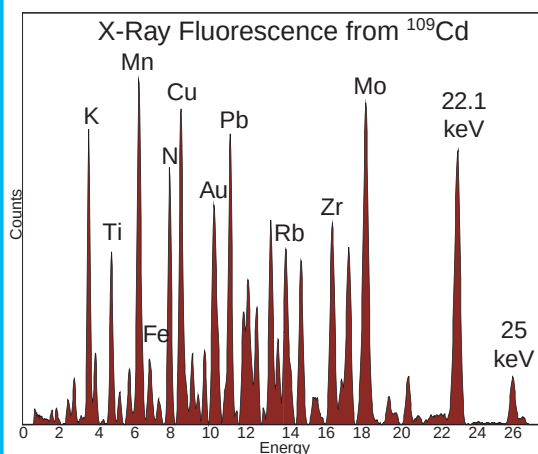


SPECIALIZED PRODUCTS > C³ISR > GOVERNMENT SERVICES > AM&M
Electron Devices

L-3com.com

X-Ray Detector

XR-100CR at **149 eV FWHM** Resolution



No Liquid Nitrogen

Solid State Design

Easy to Use

Low Cost

APPLICATIONS

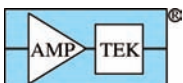
- Nuclear Physics
- Synchrotron Radiation
- High Energy Physics
- Neutron Experiments
- Astrophysics
- Research & Teaching
- Nuclear Medicine
- X-Ray Fluorescence



XR100CR X-Ray Detector with PX4 Digital Pulse Processor, Power Supply, Shaping Amplifier & MCA



XR100CR fitted for vacuum applications



AMPTEK Inc. 14 DeAngelo Drive, Bedford, MA 01730-2204 USA

Tel: +1 (781) 275-2242 Fax: +1 (781) 275-3470

E-mail: sales@amptek.com

Visit Us Now
www.amptek.com

Complete X-Ray Spectrometer

INCLUDES

- 1 X-Ray Detector and Preamplifier
- 2 Digital Pulse Processor and MCA
- 3 Power Supply



7 x 10 x 2.5 cm (2.7 x 3.9 x 1 in)

The X-123 is a complete X-Ray Detector System in one small box that fits in your hand.

Features of the X-123:

- Simple to Operate
- Low Power (1.2 Watts)
- Small Size
- USB and RS232 Communication
- Accommodates all Amptek Detectors